

UNIT
3

Electric, Gravitational, and Magnetic Fields



OVERALL EXPECTATIONS

DEMONSTRATE an understanding of the principles and laws related to electric, gravitational, and magnetic forces and fields.

INVESTIGATE and analyze electric, gravitational, and magnetic fields.

EVALUATE the impact of technological developments related to the concept of fields.

UNIT CONTENTS

CHAPTER 7 Fields and Forces

CHAPTER 8 Fields and Their Applications

What is it about “black holes” that stretches the imagination to the limit? Is it that black holes, such as the artist’s conception here, defy reason because both matter and energy seemingly disappear into nothingness?

A major part of understanding the black hole phenomenon lies in the characteristics of fields, regions of space over which a force seemingly acts at a distance. You are already familiar with everyday forces that act in this manner — gravity, magnetism, and electricity. Based on straightforward laboratory studies, you can begin to answer such questions as: “How are these fields formed? How are they related to each other?”

Recent research indicates, for example, that black holes are points with almost infinite density. The gravitational field generated by this concentration of mass is so strong that not only objects but even light passing within range can never escape.

This unit provides an examination of the properties of electric, gravitational, and magnetic fields. As our understanding of fields increases, so do the technological applications that use fields. You will study the fundamental properties of fields, how civilization has harnessed this knowledge, and consider possible directions for future research.

UNIT PROJECT PREP

Refer to pages 370–371. In this unit project you will prepare a report and a debate on particle accelerators and relevant research.

- How can you use electric and magnetic fields to accelerate charged particles to very high speeds?
- What are the costs and benefits to society of the research into particle accelerators and the application of the knowledge gained?